Space Weather Technical Forecast

Issued on Monday 21 October 2024 at 01:11 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1 peaking into new UTC working week. Initially reducing Chance of R-scale flare events, rising later in period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity observed at GOES16 and 18 was Low. There are eight main sunspot regions on the disc. The recent most active group, AR3854 has now crossed the western limb. Meanwhile, two new minor regions were numbered in the far east. AR3859 in the southwest showed shear and development of leading sunspot area and number, as well as some proliferation of spots within the centre of the group early in the period, although then fading a little over recent hours. AR3563 showed some proliferation in its trailer region in the period. Changes in other groups were generally of slow decay or else slow growth but from starting points of lesser complexity.

No Earth-directed CMEs were observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds speeds, as observed at L1 by ACE, declined steadily from a peak of 450km/s to around 37km/s by the period's end. The solar wind density was Average within single figures ppcc throughout. The IMF, Bt, was highest to start the 24 hours at 7nT, gradually decreasing over the ensuing day and remaining Weak. The north-south component, Bz, was Weak throughout and largely neutral. The phi angle was positive (away from the Sun) initially, becoming briefly negative from around 20/1200UTC and than neutral. Geomagnetic activity was Quiet to Unsettled.

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at Background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was mainly at Normal Background levels. The associated 24-hour fluence was below the Active threshold. The 21/0001UTC observation was 3.37e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity initially but a chance of isolated M-class flares. A steady increase in activity looks likely into the new UTC working week, with the possible return of several active regions. Activity is expected to increase from day 2 (22 Oct) onward to become generally Moderate, with occasional M-class flares likely, and an increased chance of isolated X-class flares.

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Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs currently forecast. Solar winds currently waning but a connection to the fast wind from CH82/+ is expected perhaps from later on day 1 (21 Oct), but more likely on day 2 (22 Oct). This is likely to bring Active intervals with a Chance of Minor geomagnetic storm G1 conditions at peak into the new UTC working week, before activity declines into days 3 and 4 (23-24 Oct), with activity otherwise generally Quiet to Unsettled.

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is Expected to remain at Background.

High energy electron flux at GOES16 is forecast to remain mainly Low to Moderate with the associated 24-hour fluence Expected to remain below Active (1e8 total pfu) throughout.

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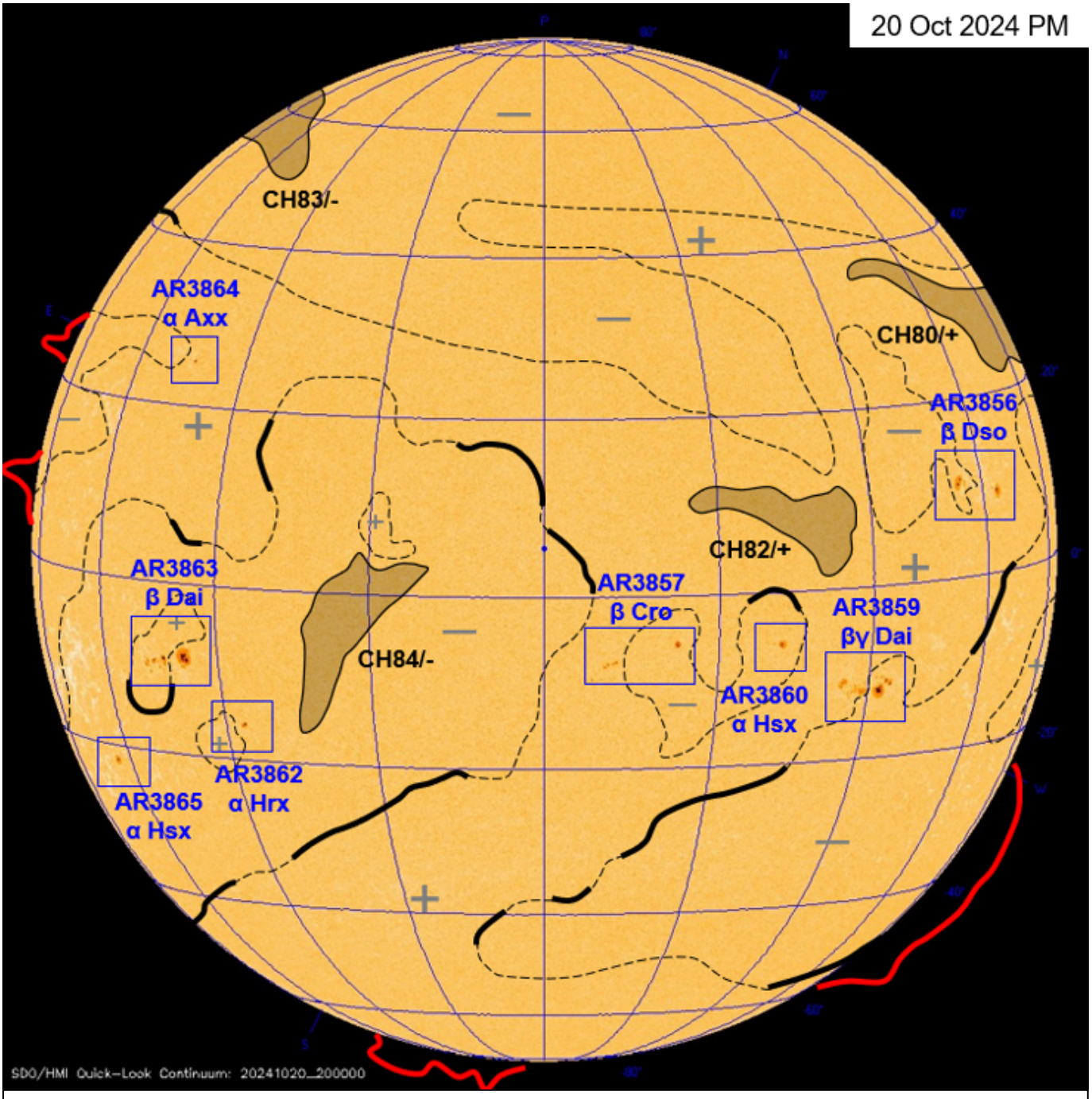
Figure 1: Solar Synoptic Map valid 20/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

There are no Earth-directed CMEs currently forecast.

Solar winds are currently Slightly Elevated but declining, likely due to fading interaction with CH80/+, the large coronal hole in the northwest. The core of the fast wind is likely passing north of Earth, and further interactions with the southern edge are now perhaps mainly passed from L1 signatures. Solar winds conditions should decline to Background into day 1 (21 Oct).

The next enhancement will then be from the likely onset of fast winds from CH82/+. This is a smaller feature, but due to its more equatorial location has a high chance of connection, with the likely arrival for any CIR region expected to occur either late on day 1 or more likely into day 2 (21-22 Oct). A period of Elevated solar winds is then expected to follow, and given G1 Minor Storm intervals were observed on the previous rotation associated with this feature, similar is possible on this occasion. MOSWOC ENLIL output does show a weak enhancement possibly associated with this feature, however this is later (in model space) than currently anticipated given the coronal hole's location, and not considered as good guidance.

Geomagnetic activity is forecast to be Quiet to Unsettled initially. Fast wind onset from CH82/+ is then expected to bring Active to G1 Minor Storm intervals, just perhaps from later on day 1 (21 Oct), but more likely into day 2 (22 Oct), before activity is expected to decline into days 3 and 4 (23-24 Oct).

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	50	20	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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Radio Blackouts - X-Ray Flares

The chances of further Moderate activity are now reducing in the immediate term as AR3854 fades increasingly over the southwestern limb on day 1 (21 Oct), although bright magnetic looping remain evident in SDO AIA171 imagery. Activity is expected to remain Low to Moderate into day 2 (22 Oct), with the remaining regions currently on the disc appearing relatively small and magnetically simple, with little ongoing growth. The main flare risk regions are AR3859 and AR3863, although both region so far remain generally stable. A steady increase in activity looks likely into the new UTC working week however, as recurrence, recent CME activity, and far-side sounding data all suggest the possible return of several active regions. Bright looping is evident in SDO AIA171 imagery, with recurrence suggesting the return of Ex-AR3842, previous source of several strong flares, into day 3 (23 Oct). As such activity is expected to increase to become generally Moderate, with M-class flares likely, and an increased chance of isolated X-class flares.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	No	30	40	60	60
Very Active	R3-R5 (X Class)	No	5	5	10	10

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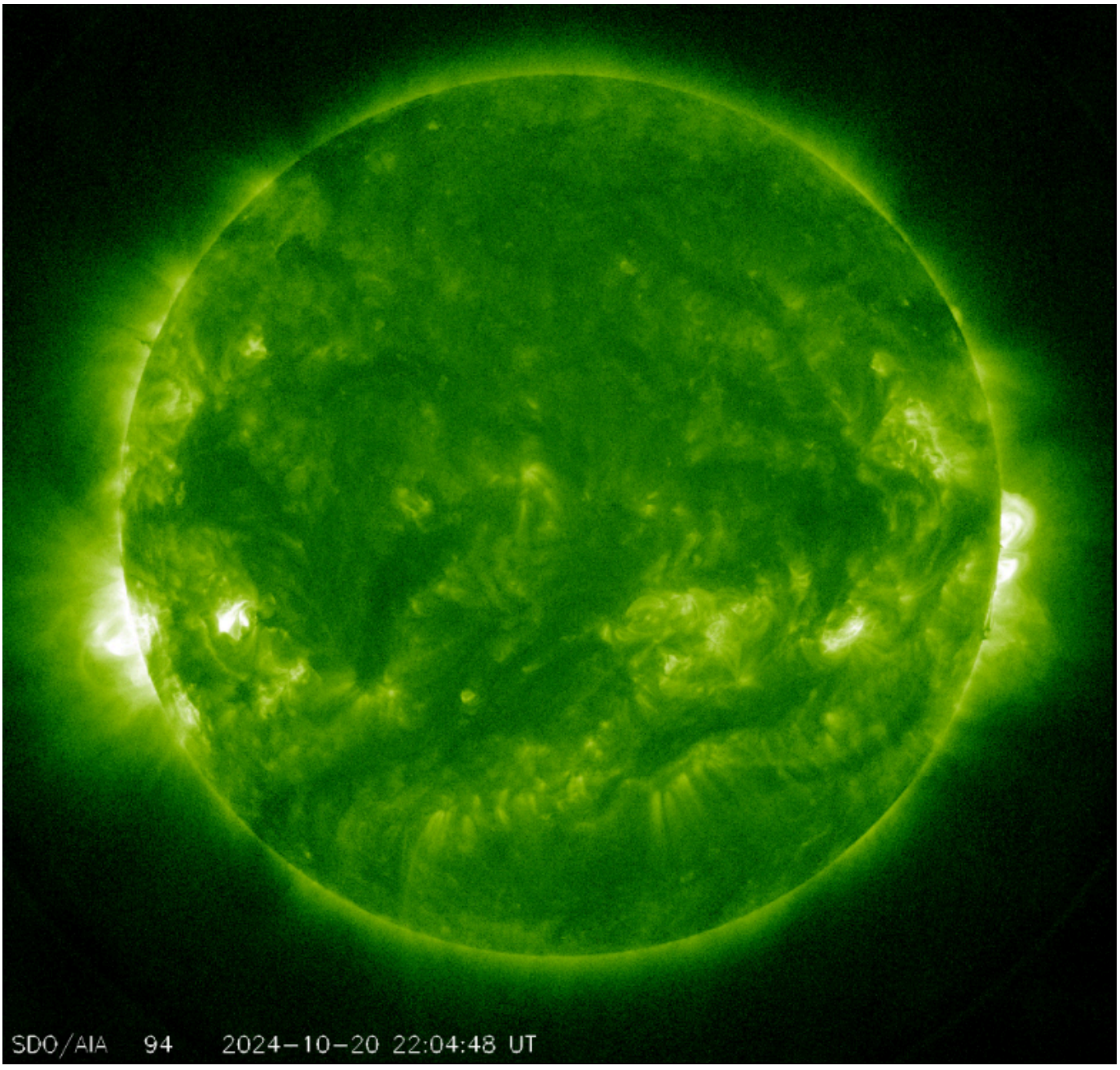
Figure 2: SDO/AIA 94 imagery valid 20/2204UTC, showing brightening associated with AR3854 departing the W limb, as well as significant brightening from oncoming region/regions approaching the E limb.



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Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is expected to remain at Background. There is a Slight Chance of enhancement in the immediate term due to the recent activity of AR3854 as it moves over the southwestern limb, should any more significant flares occur. Otherwise, there is only a very slight chance of enhancement, with limited flare activity from the other regions currently on the disc.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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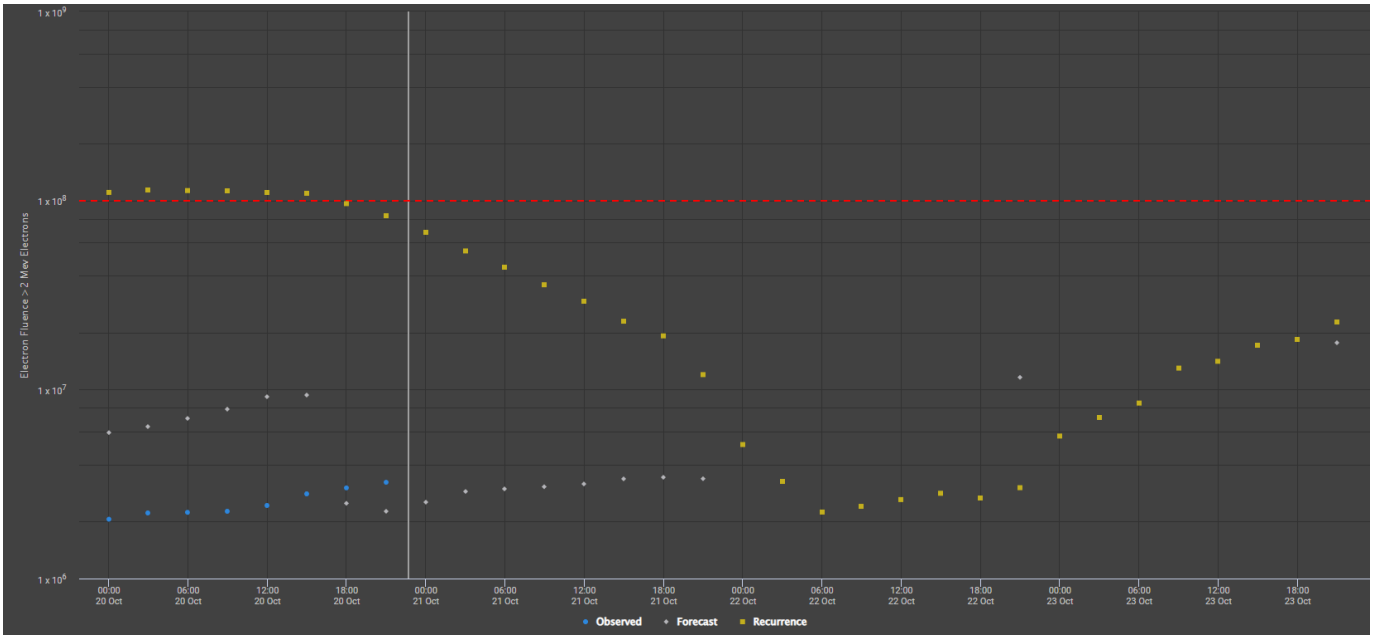
High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES16 has mainly been at Normal Background to Moderate levels. The expected onset of fast winds from central disc CH82/+ are also likely to further suppress flux values at GEO for a time, but with an eventual chance of rising back towards Moderate levels into day 4 (24 Oct).

The associated 24-hour fluence is currently expected to remain below Active throughout the period, with MOSWOC REFM thought to be providing generally good guidance.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ 1×10^{8}**	No	1	5	10	10
Very Active	**≥ 2 MeV ≥ 1×10^{9}**	No	1	1	1	1

Figure 3: Latest MOSWOC REFM model output.



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